

OAQPS CONTROL COST MANUAL

Fifth Edition

EPA 453/B-96-001
February 1996

Environmental
Scanning System

United States Environmental Protection Agency
Office of Air Quality Planning and Standards

Research Triangle Park, North Carolina 27711

This fifth edition of the *OAQPS Control Cost Manual* was prepared by the Emissions Standards Division of the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use. Copies of this report are available through the OAQPS Control Technology Center (MD-13), U.S. Environmental Protection Agency, Research Triangle Park NC 27711, or from the National Technical Information Service, 5285 Port Royal Road, Springfield VA 22161, (phone: 1-800-553-6847.)

Questions and comments should be addressed to the principal author, William M. Vataavuk, OAQPS, phone 919-541-5309, fax 919-541-0839.

Chapter 1

INTRODUCTION

William M. Vatauvuk
Innovative Strategies and Economics Group, OAQPS
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

December 1995

Contents

1.1 Role of Cost in Setting of Regulations	1-2
1.2 Purpose of Manual	1-2
1.3 Organization of the Manual	1-3
1.4 Intended Users of the Manual	1-4
1.5 "Uniqueness" of the Manual	1-4
References	1-6

1.1 Role of Cost in Setting of Regulations

Cost has an important role in setting many state and federal air pollution control regulations. The extent of this role varies with the type of regulation. For some types of regulations, such as Maximum Achievable Control Technology (MACT) standards, cost is explicitly used in determining their stringency. This use may involve a balancing of costs and environmental impacts, costs and dollar valuation of benefits, or environmental impacts and economic consequences of control costs.

For other types of regulations (e.g., National Ambient Air Quality Standards), cost analysis is used to choose among alternative regulations with the same level of stringency. For these regulations, the environmental goal is determined by some set of criteria which do not include costs. However, cost-effectiveness analysis is employed to determine the minimum cost way of achieving the goal.

For some regulations, cost influences enforcement procedures or requirements for demonstration of progress towards compliance with an air quality standard. For example, the size of any monetary penalty assessed for noncompliance as part of an enforcement action needs to be set with awareness of the magnitude of the control costs being postponed by the noncomplying facility. For regulations without a fixed compliance schedule, demonstration of reasonable progress towards the goal is sometimes tied to the cost of attaining the goal on different schedules.

Cost is a vital input to two other types of analyses that also sometimes have a role in standard setting. Cost is needed for a benefit-cost analysis that addresses the economic efficiency of alternative regulations. Cost is also an input into any analysis of the economic impact of each regulatory alternative. An economic impact analysis deals with the consequences of the regulation for small businesses, employment, prices, and market and industry structure.

1.2 Purpose of Manual

The purpose of this *Manual* is two-fold: (1) to compile up-to-date capital costs, operating and maintenance expenses, and other costs for "add-on" air pollution control systems and (2) to provide a comprehensive, concise, consistent, and easy-to-use procedure for estimating and (where appropriate) escalating these costs. The EPA report, Escalation Indexes for Air Pollution Control Costs (EPA-452/R-95-006, October 1995) provides data and a procedure for escalating control device equipment costs. The data are in the form of indexes ("Vatavuk Air Pollution Control Cost Indexes" or "VAPCCI") that are updated quarterly. This report and the updated indexes are installed on the OAQPS Technology Transfer Network (TTN), Control Technology Center (CTC) bulletin board. ("Add-on" systems are those installed downstream of an air pollution source to control its emissions.)

The *Manual* estimating procedure rests on the notion of the "factored" or "study" estimate, nominally accurate to within $\pm 30\%$. This type of estimate is well suited to estimating control system costs intended for use in regulatory development. Study estimates are sufficiently accurate, yet do not require the detailed, site-specific data inputs needed to make definitive or other more accurate types of estimates.

1.3 Organization of the Manual

This *Manual* is a revision of the 1990 edition of the *OAQPS Control Cost Manual*, [1] which, in turn, was a revision of the edition completed in 1987. This fifth edition of the *Manual* includes sizing and costing procedures and data for eight types of add-on control devices and three kinds of auxiliary equipment (See Table 1.1). This edition includes revisions to all ten Chapters in the fourth edition (*i.e.*, the base *Manual* plus Supplements 1–3). The revisions mainly consist of corrections and updates, most of which are minor.

As with the third edition, this edition has been issued in self-contained chapters. Each chapter addresses a logically separate topic, which can be either of a general nature (*e.g.*, this introduction) or of a more specific, equipment-oriented nature (*e.g.*, fabric filters). The chapters which comprise this portion of the *Manual* are listed in Table 1.1, alongside the portions of the 1990 *Manual* they replace.

As in the fourth edition, each type of equipment (control device or auxiliary), background topic, etc., is given its own chapter number for ease of identification and to reinforce the intent that each chapter should stand alone.

Table 1.1: Contents of the *OAQPS Control Cost Manual* (Fifth Edition)

Chapter		4 th Edition <i>Manual</i> Portion
No.	Title	Replaced (Date)
1	"Introduction"	Base Manual (1990)
2	"Cost Estimating Methodology"	" "
3	"Thermal and Catalytic Incinerators"	" "
4	"Carbon Adsorbers"	" "
5	"Fabric Filters"	" "
6	"Electrostatic Precipitators"	" "
7	"Flares"	Supplement 1 (Apr. 1991)
8	"Refrigerated Condensers"	Supplement 1 (Nov. 1991)
9	"Gas Absorbers"	Supplement 2 (Oct. 1992)
10	"Hoods, Ductwork, and Stacks"	Supplement 3 (Mar. 1994)

Each of these stand-alone chapters contains a:

- *Process description*, where the types, uses, and operating modes of the equipment item and (if applicable) its auxiliaries are discussed;
- *Sizing (design) procedure*, which enables one to use the parameters of the pollution source (e.g., gas volumetric flow rate) to size the equipment item(s) in question;
- *Capital and annual costing procedure and data* for the equipment and suggested factors to use in estimating these costs from equipment design and operational (e.g., operating hours) parameters. These costs are presented in both graphical and equational forms wherever possible. To complement the Manual costs, Lotus spreadsheets have been developed. These spreadsheets (filename: COST.AIR.ZIP), which have been installed on the CTC bulletin board of the TTN, allow the user to size and cost any of the control devices covered in the Manual, plus several others (e.g., venturi scrubbers).
- *Example problem* to illustrate the sizing and costing procedures presented in the chapter.

1.4 Intended Users of the Manual

As explained in Section 1.2, the *Manual* provides comprehensive procedures and data for sizing and costing control equipment. Some of these procedures are based on rigorous engineering principles, such as the material and engineering balances in Chapter 3. To fully appreciate, and correctly apply, these procedures the user should be able to understand them. Moreover, the user should be able to exercise "engineering judgement" on those occasions when the procedures may need to be modified or disregarded. Typically, only engineers and others with strong technical backgrounds possess this kind of knowledge. Hence, the *Manual* is oriented toward the *technical* not the non-technical user.

1.5 "Uniqueness" of the Manual

The *Manual* presents a different perspective on estimating air pollution control system costs than other cost-oriented reports, such as:

- *The Cost Digest: Cost Summaries of Selected Environmental Control Technologies* [2]
- *A Standard Procedure for Cost Analysis of Pollution Control Operations* [3]
- *Handbook: Control Technologies for Hazardous Air Pollutants* [4]

Although these reports (as well as many of the MACT Regulatory Impact Analyses and other standards-supporting documents) contain costs for add-on control systems, they do not duplicate the *Manual* for one or more of the following reasons: (1) their costs have been based

either wholly or partly on data in the previous *Manuals*; (2) they apply to specific source categories only, whereas the *Manual* data may be applied generally; (3) their estimating procedures and costs are of less than study estimate quality; or (4) they are not intended for estimating costs used in regulatory development.

Reason (3) applies to the *Cost Digest*, for example, as this report, designed for use by non-technical personnel, contains procedures for making *order-of-magnitude* estimates ($\pm 30\%$ accuracy or worse). A *Standard Procedure*, conversely, was primarily intended for estimating costs for R&D cases (e.g., demonstration projects), where some site-specific data are available. Further, although the latter report contains a thorough list of equipment installation factors, it contains few equipment *costs*. The report, *Handbook: Control Technologies*, used data and estimating procedures from the 1990 *Manual* to provide sound generalized procedures for estimating costs for various types of control equipment. The fifth edition of the *Manual* supplements this information.

Finally, since its inception, the *Manual* has been extensively used to support Agency regulatory development, state permitting programs, and other activities where current, consistent, and comprehensive control cost data are required. Accordingly, the *Manual's* role in the specialty of air pollution control system cost estimating is both unique and secure.

References

- [1] *OAQPS Control Cost Manual* (Fourth Edition), EPA, Office of Air Quality Planning and Standards, Emissions Standards Division, January 1990 (EPA 450/3-90-006 [NTIS/PB90-169954]).
- [2] DeWolf, Glenn, *et al.* (Radian, Inc.), *The Cost Digest: Cost Summaries of Selected Environmental Control Technologies*, EPA, ORD, Office of Environmental Engineering and Technology, October 1984 (EPA-600/884-010).
- [3] Uhl, Vincent W., *A Standard Procedure for Cost Analysis of Pollution Control Operations*, Volumes I and II, EPA, ORD, Industrial Environmental Research Laboratory, June 1979 (EPA-600/8-79-018a).
- [4] *Handbook: Control Technologies for Hazardous Air Pollutants*, EPA, Office of Research and Development, Air and Energy Engineering Research Laboratory, June 1991 (EPA-625/6-91-014).